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A PROCESS FOR PRODUCING FRAYING-RESISTANT MOP CORD YARNS

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Inventors: Yuji Marutani

1-12-47-1207 Esaka-cho, Suita-shi

Keizo Senmura

8, 2-chome, Yamada Nishi, Suita-shi

Applicant: Duskin Co. Ltd.

11-16, 4-chome, Toyosaki, Oyodo-ku, Osaka-shi

Patent Attorney: Ikuo Suzuki

SPECIFICATION

1. Title of Invention

A process for producing fraying-resistant mop cord yarns

2. Claims

(1) A process for producing fraying-resistant mop cord yarns characterized in that a plural number of mop cord basic yarns comprising natural fiber, synthetic fiber or their mixture are twisted with heat bonding type nylon filament yarn; said twisted yarn being immersed in a hot water bath maintained at a temperature higher than the wet heat melting point of said bonding type nylon filament yarn; and the mop cord basic yarns being fixed together through the melted heat bonding type nylon filaments.

(2) A process according to Claim 1, wherein mop cord basic yarns comprise polyamide fiber.

(3) A process according to Claim 1, wherein heat bonding type nylon filament yarn is low-melting copolyamide filament having a wet heat melting point of less than 100°C.

3. Detailed Description of Invention

Field of industrial use

The present invention relates to a process for producing fraying-resistant mop cord yarns. More particularly, the present invention pertains to mop cord yarns which are used for mops for cleaning and are free of fraying and abrading of twist yarns even after repeated cleaning and washing operations.

Prior art and technical theme of Invention

Conventionally, twisted yarns which comprise a plural number of thick yarns (called basic yarns) twisted together have been used generally as mop cord yarns for cleaning. In the form of a mop for cleaning, the end of the mop cord is in the free state with the twist yarn cut. This cut end begins to be untwisted; which leads to considerable fraying and abrading of the yarn. Particularly mops for cleaning are put under severe conditions of use such as abrasion with the floor surface. They are also put under severe washing conditions even after the use. Therefore, fraying from the end of the mop cord yarns and abrading are considerable; which leads the mop to the unusable state at the final stage. For this reason, it becomes important to prevent untwisting of the mop cord yarns from their cut end in view of maintaining the quality and the long life of the mop cord yarns.

As a process for production of cord yarns for mops free of fraying practiced in the prior art, there has been a process wherein fraying of twisted yarns is prevented by shrinking cotton yarns (generally called mercerization) by immersing a plural number of cotton yarns in a twisted state in caustic alkali solution. However, this process of preventing fraying is limited to cotton or cotton blend products and is not suitable for synthetic fibers and semi-synthetic fibers.

There have been some attempts made already to prevent fraying and abrasion of twisted yarns by subjecting a plural number of twisted mop cord basic yarns to a treatment making use of heat fusion of resins. For example, in Japanese Patent Publication No. 53-13907 there is a disclosure that fraying of twisted yarns is prevented by interspersing fine low-melting resin particles such as polyethylene on the surface of twisted

yarns for mops and conducting a fusion treatment in the form of independent spot bonding. Also, in Japanese Patent Application Publication No. 57-177729 there is a disclosure of a process wherein twist yarns comprising a plural number of coarse basic yarns and core yarns of low-melting synthetic fiber such as polypropylene are prepared; said twist yarns being heat treated in the compressed state while feeding them under tension; and the core yarns being fused on the bonding surface of each basic yarn. Further, in Japanese Patent Application Publication No. 58-163745 there is a disclosure of a process wherein cotton yarns and heat bonding type synthetic filaments such as polyethylene are entwined with each other and treated in a pressure container under heat pressure and in the presence of water vapor, thereby fusing the filament yarns.

These processes for preventing fraying, however, have drawbacks that since polyethylene and polypropylene used for fusion have adsorbency to oil, oil stain adheres and accumulates on the heat fusion portions, and the life of use of mops is shortened due to this oil stain after several times of repeated use and washing. Further, these processes have drawbacks that a temperature for fusion treatment is still considerably high, cost of energy for the heat treatment is high, and further said processes readily accompany thermal deterioration of mop cord yarns.

Objects of Invention

Accordingly, it is an object of the present invention to provide a process for producing mop cord yarns free of fraying and abrading of twist yarns as well as adhesion of oil stains and the like.

It is another object of the present invention to provide a

process for producing mop cord yarns wherein prevention /Missing, Page 2, Column 3, Line 4, Translator/ of fraying and abrasion of the twist yarns is done readily without application of severe conditions that may spoil flexibility, freedom nor texture of the mop cord yarns and damaging the fiber.

Structure of Invention

The present invention provides fraying-resistant mop cord yarns characterized in that a plural number of mop cord basic yarns comprising natural fiber, synthetic fiber or their mixture are twisted with heat bonding type nylon filament yarn; said twisted yarn being immersed in a hot water bath maintained at a temperature higher than the wet heat melting point of said bonding type nylon filament yarn; and said mop cord basic yarns being fixed together through the melted heat bonding type nylon filaments.

Preferred embodiment of Invention

The present invention is described further in detail by means of a preferred embodiment hereinafter.

Materials

In the present invention, optional mop cord basic yarns comprising natural fiber, synthetic fiber or their mixture are used as mop cord basic yarns. Fibers constituting the basic yarns are, for example, cellulose group fibers such as cotton, Rayon and acetate fibers; and synthetic fibers such as polyvinyl alcohol fiber, nylon fiber, acrylic fiber, polyester fiber and polyvinyl chloride fiber. It goes without saying that these fibers are individual spun yarn or blended yarn of more than 2 kinds thereof. These basic yarns may be spun yarns of natural

or synthetic staple fiber. In case of synthetic fiber, the basic yarns may be multifilament yarns.

Preferable mop cord basic yarns have 500 - 10000 deniers. It goes without saying that these basic yarns may be filaments, a plural number of the same or different kinds of twist yarns or ply yarns. The denier of cotton yarn is shown by yarn count. Yarn count and denier are converted by the following equation.

Yarn count = 5.315/deniers

Fibers preferred in view of cleaning performance and stain resistance are cotton yarn, nylon fiber and acrylic fiber in the order from the most important fiber.

In the present invention, the mop cord basic yarns described above are bonded by use of heat bonding type nylon filaments, i.e., low-melting nylon filaments. Low-melting nylon filaments are copolymerized nylons which consist of a combination of a plural kinds of nylon forming monomers, e.g., ω-amino carboxylic acid component or dicarboxylic acid component and diamine component, and have a melting point generally in a range of 80 - 140°C. It is one of the noticeable characteristics that said low-melting nylon filaments melt under the wet heat condition at a temperature much lower generally by 20 - 40°C than that under the dry heat condition. In the present invention, twist of the yarns is fixed making use of this characteristic under mild conditions without damaging the fiber of the mop cord yarns and marring their flexibility, freedom and texture. Said low-melting nylon filaments are also available generally in the form of multifilaments of a small size, and their size is generally in a range of 30 - 300 deniers.

Preferable low-melting nylon filament yarns are available from Toray Co. Ltd. in the product name of Elder and from Unitika Co. Ltd. in the product name of Flore-M.

Production process

In accordance with the present invention, the foregoing mop cord basic yarns are entwined around said heat bonding type nylonfilament yarn by twisting them together.

At this time, it is desirable that the mop cord basic yarns have a first twist of 80 - 180 times/m, particularly 100 - 150 times/m and a final twist of less than the number of twist of the first twist and also 50 - 150 times/m, particularly 70 - 130 times/m in the direction opposite to the first twist. It is advantageous to have the number of final twist less than that of the first twist by 10 - 80 % in view of fixation in connection with the fusion treatment described below.

When the numbers of twist of the first twist and the final twist are below the range described above, fixation of twist of yarns is insufficient even when subjected to the treatment described below; which leads to increased tendency of fraying and abrading of the yarns during the repeated use of the mop. On the other hand, when the numbers of twists are above the range described above, flexibility and freedom of the mop cords are lost; which leads to tendency of reduction of dust collecting and retaining properties as well as deterioration of cleaning performance and texture.

The ratio of the mop cord basic yarns to the low melting nylon filaments to be used can be varied in a wide range. However, it is preferable to have the blending ratio shown with $d_2/d_1 \times 100$ (where d_1 is the denier of the former

component and d_2 is the denier of the latter component, respectively) in a range of 0.1 - 15 %, particularly 0.1 - 10 %. In other words, when the ratio of the low melting nylon filaments used is below the range defined above, fixation of the twist is insufficient. On the other hand, when said ratio is above the range defined above, flexibility of the yarns is lost and the cost of production is increased.

The plural number of mop cord basic yarns and the low-melting polyamide filament yarns can be twisted together in a range that satisfies the limit described above by various systems. For example, the yarns can be twisted together so that the low-melting polyamide filament yarn is positioned in the center of the plural number of mop cords. It is also allowed to twist the yarns together so that the mop cord basic yarns cover in the form of sheath around the low-melting nylon filament yarn as a core. It is desirable to apply generally 2 - 10 pieces, particularly as little as 2 - 7 pieces of mop cord basic yarns.

In a particularly preferred embodiment of the present invention, multifilament yarns of 5 - 30 filaments having the twist number substantially corresponding to the twist number of the final twist in the direction opposite to the final twist of the twist yarn are used as low-melting polyamide filament yarn. When such low-melting nylon multifilament yarns are used, untwisting of the multifilaments is caused at the time of twisting and the low-melting nylon filaments are distributed in a relatively wide area in the twist yarn, thereby enabling bonding each basic yarn at a number of points effectively.

In accordance with the present invention, the twist yarns produced in this manner are treated in a bath maintained at a temperature higher than the wet heat melting point of the low-melting nylon filaments, and the basic yarns are fused

together with the low-melting nylon positioned among them.

The low-melting nylon, as is described hereinbefore, shows a considerably low melting temperature at the time of wet heat than at the time of dry heat. In the present invention, the fusion treatment is conducted in a bath by making use of these characteristics.

A water bath is normally used as the bath. It is also allowed to use a dyeing bath and conduct the abovementioned treatments simultaneously with dyeing. The temperature of the bath may be generally in a range of 70 - 100°C. It is also possible to conduct the treatment at a higher temperature by adding inorganic salts and water soluble organic compounds into the bath in order to improve the boiling point of the solution. Further, it is possible to conduct the treatment at a higher temperature by use of a pressure resistant container as a container to accommodate the bath.

The treatment of the twist yarns in a bath can be conducted by feeding the twist yarns continuously into such a bath as a J-box and by immersing hanks and cones of the twist yarns, etc. in the bath. Any immersing time in the bath is applicable as long as fusion can be ensured. Generally immersion treatment for several minutes to several tens of minutes is sufficient.

It goes without saying that the mop cord yarns in accordance with the present invention can be subjected to conventionally known optional processings such as dyeing, finishing processing, oiling processing, etc.

Mop cord yarns and functional effects

The mop cord yarns in accordance with the present invention

have an advantage that the mop cord basic yarns are fused mutually with the low-melting nylon present among them at many points and fixation of the twist by heat setting is ensured without spoiling the flexibility, freedom and texture that the mop cords possess originally.

Further, in the present invention, the fusion treatment is conducted in a hot bath. Therefore, the present invention has advantage that not only the operation is simple but also the treating conditions applied are mild and the excellent strength of the mop cord basic yarns is maintained without abrading the mop cord basic yarn fiber.

In accordance with the present invention, the mop cord yarns obtained are sewn to a base cloth such as canvas or sewn entirely by flanging, etc., and the cords are cut into fixed uniform length for use as mops for cleaning. It goes without saying that the foregoing treatments may be conducted on the mop cords produced in the form of mops in the reverse order of the treatments.

It is also possible to impregnate said mops with known oil agents for collecting and retaining dust to prepare into rental dust control mops to be used in a dry state.

Examples

The present invention is described further in details hereinafter by means of the following examples.

[Example 1 & Comparative Examples 1 - 2]

Cotton yarn of yarn count 2 and 2 pieces of copolymerized low-melting nylon multifilament yarn (100 d/12 filaments, Z

twist, the number of twist 35 T/m) having a dry heat melting temperature of approximately 100°C and a wet heat melting temperature of approximately 80°C were fed to a twister together, and 2 pieces of twist yarn having a first twist of Z 120 T/m and a final twist of S 154 T/m were produced.

The hank of said twist yarns was immersed in a hot water bath of approximately 90°C in the state under tension for approximately 15 minutes to conduct the fusion treatment. Said cord yarns were cut into 20 cm long pieces. Lines of many pieces of said cord yarn were sewn to cloth tape, and a mop was produced.

For comparison, 2 pieces of twist cotton yarns of yarn count 2 were produced in the same manner as above except eliminating the use of the low-melting nylon multifilament yarn. To said twist yarn, 10 % of fine polyethylene powder having a softening point of 84°C was adhered on said twist yarns based on the yarn weight and heated in an electric heating type heating oven at 200°C for 1 minute to produce fusion treated yarn. Then a mop (Comparative Example 1) was produced from the mop cord yarn thus obtained in the same manner as above.

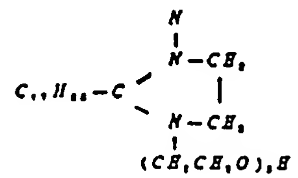
Further, a mop (Comparative Example 2) was produced in the same manner as in the above example except using cotton twist yarn that was not subjected to the fusion treatment with fine polyethylene powder as mop cord yarn.

These mops were impregnated with oil in the following manner.

The following oil agent composition, i.e., the following mixture was prepared.

Liquid paraffin	40 parts
Alkyl benzene oil	53 parts
Surfactant	3 parts

70 % of



and 30 % of $C_{19}H_{33}CONHCH_2NH(CH_2CH_2O)_3H$.

The treated mop in Example 1 and the mops in Comparative Examples 1 and 2 were immersed in a water bath at 60°C so as to have a bath ratio of 10:1, and the pH of the bath was adjusted to 4.5.

The above oil agent composition was added into said bath in a ratio of 15 % per fiber, and emulsion of the oil agent was formed.

The oil agent composition was sucked up into the mop pile along with passage of time. In each case of the mop pile yarns, the solution became transparent.

After the oil impregnation treated mops obtained in this manner were dehydrated and dried, the following tests were conducted on them.

(1) Cleaning performance test:

These mops were attached to a mat holder. Five panelists conducted floor cleaning practically. Evaluation of easiness of cleaning with the mops and the texture of the mops was performed using scores of 5 – excellent, 3 – good and 1 – passed, and the

results were shown with the sum.

(2) Dust collecting property:

One mop described above and silica sand powder in the amount twice as much as the weight of said mop were put in a polyethylene container and shaken well with a lid on to adhere the silica sand powder on the cloth uniformly. Subsequently, the silica sand powder lightly adhered on said cloth was shaken off. The rate of increased weight before and after this operation is shown as a dust collecting rate.
That is:

$$\text{Dust collecting rate} = \frac{b - a}{a} \times 100 \ (\%)$$

(where a : weight of the cloth before the test
b : weight of the cloth after the test)

(3) Mop cord yarn abrasion test:

An operation of wiping a Japanese straw mat in the length direction of the straws with each mop described above was repeated, and the number of wiping times until the wiping operation became impossible by the loss of pile was obtained.

(4) Durability test:

The cycle of cleaning and washing followed by regeneration treatment of the foregoing mops by oil impregnation for 4 weeks was repeated 10 times, and fraying of the mop cord yarns and the degree of resoiling thereof were evaluated.

The results obtained are shown in Table 1.

Table 1

	Example 1	Comparative Example 1	Comparative Example 2
Cleaning performance	19	5	21
Dust collecting rate (%)	105.3	91.4	107.0
Number of abrading times	50.000	20.000	5000
Durability			
Length of fraying	Almost none	0.5~1 cm	Frayed over the entire length (about 9 cm)
Abrasion rate	26 %	5.7 %	32 %
Resoiling	No discoloring	Considerable discoloring into charcoal color	No discoloring

As is apparent from the results shown above, the mop cord yarns obtained in accordance with the process of the present invention, due to the characteristic that a plural number of basic yarns are fused to each other at a number of their contacting points, have the same cleaning performance, texture and dust collecting property as those of untreated mop cord yarns, are free of oil stain compared with the conventional fused yarns, and have a remarkable functional effect in view of prevention of fraying and abrading.

ısl.: Tech. Lib. Network
Pascal T.S.
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